ENTREPRENEURIAL DISCOVERY AND EXPLOITATION PROCESSES: SEQUENCE OR SYMBIOSIS?

Scott R. Gordon, Queensland University of Technology, Australia

ABSTRACT

This study examined the effect that temporal order within the entrepreneurial discovery-exploitation process has on the outcomes of venture creation. Consistent with sequential theories of discovery-exploitation, the general flow of venture creation was found to be directed from discovery toward exploitation in a random sample of nascent ventures. However, venture creation attempts which specifically follow this sequence derive poor outcomes. Moreover, simultaneous discovery-exploitation was the most prevalent temporal order observed, and venture attempts that proceed in this manner more likely become operational. These findings suggest that venture creation is a multi-scale phenomenon that is at once directional in time, and simultaneously driven by symbiotically coupled discovery and exploitation.

INTRODUCTION

Although entrepreneurship scholars are showing interest in processes of entrepreneurial action (van de Ven & Engleman, 2004), there remains little consensus on conceptualization, operationalisation, analytical approach, or results. Some agree (Zahra, Sapienza, & Davidsson, 2006) the twin concepts of entrepreneurial discovery and exploitation (Shane & Venkataraman, 2000) are useful sub-processes which, together, explain venture emergence (Davidsson, 2008). Here, an implicit assumption is that discovery is enacted prior to exploitation (Kirzner, 1979; Eckhardt & Shane, 2003, 2010). However, other literature questions the strictness of this ordering (Bhave, 1994; Sarasvathy, 2001), or suggests that discovery and exploitation might overlap (Davidsson, 2008) or even converge (Baker, Miner, & Eesley, 2003).

The order in which a process plays out in time is assumed "important to the integrity of a phenomenon" (Huy, 2001: 613). In fact, "many process theories are founded on the idea that there are fundamental similarities in the patterns of event sequences across cases" (Langley, 1999: 697). Moreover, the order in which a process plays out in time is considered influential in driving outcomes of that process. For example, in competition between established firms, performance has been directly attributed to sequence characteristics of the actions they take (Ferrier, 2001), and organization creation the result of a recipe which describes sequenced steps (Brown & Eisenhardt, 1997). Despite this inherent importance, there is a dearth of conceptual and empirical research accounting for the temporal structure (Kelly & McGrath, 1988) of new venture emergence. As a result, this order hypothesis remains largely untested. This is a fundamental gap in our understanding of the venture creation process. While we know that different conceptualizations suggest different orders for discovery and exploitation, we do not know whether this matters in any substantive sense. Informed by these observations, the central question to be addressed is as follows: Is there a general order to the venture creation process? Further, does the specific order in which a venture creation process is executed drive outcomes?

Accordingly, this research makes three substantive contributions in pursuit of these research questions. Firstly, the literature is extended, suggesting that by paying attention to theoretical and temporal "scale" resolution may be made between paradoxical conceptualizations of discovery-exploitation which view the sub-processes as alternatively sequential or symbiotic. Secondly, this research empirically tests the temporality of discovery and exploitation venture creation processes.

Thirdly, it applies a novel method for such process analysis adapted from applied sociology (Abbott, 1990).

The paper proceeds as follows. Beginning with a review of process theories it develops a synthesis highlighting the utility in conceptualizing acts of discovery and exploitation as the sub-processes driving venture creation. This is followed by a focus on the temporal structure implied by various theoretical perspectives. The review then turns to addressing the scale at which theory holds. A number of hypotheses are developed from the theory which focuses on the general order and the specific order of discovery and exploitation actions. This includes the suggestion that their sequence of enactment impacts upon venture outcomes. Next a method is detailed which accounts for sequences of action holistically, and allows their differential effects to be measured. Hypotheses are tested using theoretically derived "archetypical sequences". Finally a number of practical, theoretical and methodological implications are drawn.

VENTURE CREATION PROCESSES OF DISCOVERY AND EXPLOITATION

Much, prior research on the temporal nature of venture emergence has either focused on a) outcomes driven by the presence of single activities (Delmar & Shane, 2003); b) the interrelationships between several atomistic activities (Liao, Welsch, & Tan, 2005); or c) logical groupings of "like activities" (Brush, Manolova, & Edelman, 2008b). However, the unitary event approach seems to deny the process nature of emergence, and perhaps is unsophisticated in elevating a single action over all others. To the opposite extreme, it is difficult to draw generalizable conclusions from the exponential complexity that results when accounting for all temporal orderings possible between all discrete activities possible during the entire venture emergence process (Liao et al., 2005). However, by turning to conceptual groupings of activities, based on different process models, progress can be made in reducing this complexity (Davidsson & Gordon, in press).

A common thread running through much theoretical and empirical research on the venture creation process is the dichotomy between the sub-processes of discovery and exploitation (Shane & Venkataraman, 2000; Eckhardt & Shane, 2003; Shane, 2003). Sub-process components, like this, which deal with the conceptual (discovery) and the concrete (exploitation) is a characteristic shared with other process models in entrepreneurship (Sarasvathy, 2001). Discovery is a process that entails an initial recognition, and elaboration of a venture idea. This process is one that is inherently conceptual (Shane & Venkataraman, 2000; Ardichvili, Cardozo, & Ray, 2003). As Davidsson (2007) points out cognitive-behavioural approaches are particularly useful in investigating the discovery processes of the entrepreneurship phenomenon, as distinct from the exploitation processes which might draw more heavily on sociological or behavioural-economic theory. Further, the literature argues that exploitation is a separate constituent sub-processes of entrepreneurship (Shane & Venkataraman, 2000). Eckhardt & Shane (Eckhardt & Shane, 2010: 62) delineate discovery from exploitation in a similar way to Davidsson (2004) "After an entrepreneur has discovered an opportunity, he or she may decide to exploit it, which we define as taking action to gather and recombine the resources necessary to pursue an opportunity, as opposed to the mental activities of recognition and evaluation". Accordingly, this research adopts the definition detailed in Davidsson (2008: 39) that *Discovery* refers to "*the conceptual side of venture development, from an initial idea to a fully worked out business concept*", thus discovery itself is assumed a process. *Exploitation*, on the other hand, is defined as *the actions taken to bring the business concept into being*.

The empirical evidence clearly establishes that while discovery and exploitation are distinct, they are conjoined. Discovery and exploitation are by their nature two halves of a whole, the entrepreneurship process is incomplete without both being present. Just discovering something does not constitute entrepreneurship, neither does enacting discovery type activities, such as

writing a business plan. As for exploitation, there is nothing to exploit if not for the discovery innate in the conception of a clear venture idea. In this sense there is an implied temporal order to discovery and exploitation, with the former preceding the latter. The discovery-exploitation model may be considered a complete process specification since temporal aspects are identified in its definition.

There are a number of benefits to considering entrepreneurial emergence as dual processes of discovery and exploitation. First, is parsimony, a dichotomy such as this is the least intricate conceptualization allowing for internal temporal order of the venture creation process to be analysed and offers a systematic way of understanding entrepreneurial action. Additionally, these sub-processes include an implied if not explicit temporal order to the way they are theorised to proceed as directional. Second, is generalisability, this dual conceptualization coincides with widely accepted theorizing on the nature of entrepreneurial behaviour (Shane & Venkataraman, 2000). The delineation between discovery and exploitation is approximated in other models (Katz & Gartner, 1988; Aldrich & Fiol, 1994). Further, this discovery-exploitation conceptualization has been scantly applied to nascent entrepreneurship process research. While the latter observation is surprising given the ubiquity of the model, it is not an explicit advantage of the approach adopted here, but merely advances what could be considered an oversight of extant research.

However, the temporal order characteristics of the discovery-exploitation model have recently been challenged in some research (Bhave, 1994; Sarasvathy, 2001; Baker et al., 2003). As a result there are two competing models of process temporality: a) *sequential* or b) *symbiotic*. The first is apriori goal driven and the process is for the most part a directional sequence (Eckhardt & Shane, 2003, 2010). This sequential process formulation captures the directionality ideas discussed thus far. The second formulation is one in which the process is less bound by directionality. Symbiotic formulations capture alternate theories where the flow between discovery and exploitation is counterintuitive, iterative or even coincident (Sarasvathy, 2001; Baker et al., 2003). One of these views may be the more accurate or elements of both perspectives may indeed be correct. If the latter compromise is the case then current knowledge is deficient. This challenge is explored in the proceeding discussion, which synthesizes literature in support of these temporal formulations for the process.

Sequential Processes

Davidsson (2008: 39) suggests of the discovery-exploitation process model that "the sequential feel of the terms "discovery, evaluation and exploitation" may give the impression of a linear orderly process". Eckhardt and Shane (2003: 163) leave little doubt in how discovery and exploitation play out in time; they "theorize that it is directional. In general opportunities exist prior to their discovery and opportunities are discovered before they are exploited. The opposite direction is not possible because opportunities cannot be exploited before they exist." There is an undeniable logic to such a directional specification of the entrepreneurship process. The assumption in this logic is that action need be constituted before it may be executed (Moorman & Miner, 1998: 702). The sequential discovery-exploitation process is driven by the initial process of discovery. In this case: heightened information gathering, superior planning and having complete conceptual clarity about the venture path is what facilitates efficient resource assembly and successful market making action in the exploitation process. The preceding elaboration suggests that a sequential discovery-exploitation process derives a beneficial performance effect. Thus:

> *H1: Venture creation outcomes vary as a result of differences in the order of discovery and exploitation; such that venture creation attempts following a sequential process, where discovery behaviours precede exploitation behaviours, more likely achieve positive outcomes.*

One point of difference in otherwise coherent sequential formulations of discovery-exploitation is deciding where to draw the line between where discovery ends and where exploitation begins. Or indeed, it may be that discovery and exploitation overlap (Davidsson, 2004). This tension is picked up scholars who offer alternate, explanations on how discovery and exploitation interact in time.

Symbiotic Processes

Though there is an implied direction to the entrepreneurship process, this direction should not be taken for granted (Davidsson, 2003). Even considering the discovery-exploitation sequence specification there is reason to question whether the venture creation process should play out in a patently linear fashion (Baker et al., 2003). For example, there are times which may require new information to be considered, and adaptations to be made to the intended path. If exploitation has already begun, this case of reconceptualization is a deviance from the sequential model. This re-ordering is something that Baker and Nelson (2005: 358) support, in finding "orderly sequential processes may be the exception in entrepreneurship". In fact, what they suggest is directional processes are those which deviate from normality. With a resolutely sequential process, there is no going "back to the drawing board". However, easing this condition may then "not require the entrepreneur to be a calculating actor driving forward through a challenging linear process" (Baker et al., 2003: 256) but allow more co-evolution between discovery and exploitation (Furr, 2009). A sequential process only allows discovery to inform exploitation, while symbiotic formulations of the process allow exploitation to inform discovery as well. This opens up the process to incorporate, feedback, learning and adaptation as part of its progression toward market exchange (Bhave, 1994). These characteristics are inherent in both improvisation and effectuation.

Improvisation "is the deliberate and substantive fusion of the design and execution of a novel production" (Miner, Bassoff, & Moorman, 2001: 314). Therefore, with improvisation, coupling in the discovery-exploitation process is strictly specified. This type of symbiotic process specification is considered pervasive in entrepreneurial action (Baker et al., 2003). Effectuation (Sarasvathy, 2001) is another process specification which picks up on this adaptive theme. Here, "the generalized aspiration of starting a business is not a necessary starting point for effectuation processes" (Sarasvathy, 2001: 247). A characteristic of this process specification is the interaction between discovery and exploitation. In some respects, improvisation is similar to effectuation, "founders may plunge into the start-up process, designing the firm as they create it. In some cases, design emerges as founders observe and provide accounts for activities they have actually undertaken" (Baker et al., 2003: 256). Both effectuation and improvisation allow adaptation to occur, describe a symbiosis between discovery and exploitation and derive performance benefits from this. In effect, symbiotic discovery-exploitation is driven by the feedback between the different sub-processes allowing adaptation, responsiveness and reformulation. The preceding elaboration suggests that a symbiotic discovery-exploitation process derives a beneficial performance effect. Thus:

> *H2: Venture creation outcomes vary as a result of differences in the order of discovery and exploitation; such that venture creation attempts following a symbiotic process, where discovery and exploitation behaviours occur simultaneously, more likely achieve positive outcomes.*

Sequence Synthesis and Scale

Considering discovery-exploitation as both sequence and symbiosis, it may appear paradoxical (Poole & van de Ven, 1989) that such nominally valid, yet vastly different notions of temporal order in the entrepreneurship process could coexist. However, the option of selecting a sequential or symbiotic formulation of venture creation process need not be an either or choice. It could be that the process plays out as a mix of both of these processes. There are four approaches

by which paradox may be resolved: opposition, spatial separation, temporal separation, and synthesis (Poole & van de Ven, 1989). Opposition suggests accepting paradox as is, and making use of the dialectic in their theoretical divergence to drive new knowledge. In a sense this is the current state of the field. Synthesis makes use of the commonalities between these theories to construct a unified theory. This is something to which the field may aspire. Alternately, an approach that moves the field from where it is, to where it could be, is to employ the methods of spatial and temporal separation as a compromise in resolving paradox. This has the potential to derive mutual benefit from enhancing elements of both approaches. Additionally, there is reason to believe this sequential-symbiotic compromise may be successful as both process formulations make concessions to the alternate conceptualization. Eckhardt & Shane (2003, 2010) offer the caveat that within their directional view that discovery occurs prior to exploitation; there can be feedback loops and iterations. Sarasvathy's (2001: 258) concession to directionality is less explicit, where she states: "the key, however, is to find a way to theorize about human behaviour without either ignoring telos altogether".

Two levels of scale are useful in exploring divergence between sequential and symbiotic formulations of the discovery-exploitation process: theory and time. The scale of theory aligns with the spatial separation solution to paradox (Poole & van de Ven, 1989), as temporal scale does with time separation. In the case of symbiotic formulations for discovery-exploitation there is a clear disjunct at both theoretical and temporal aspects of scale, when compared with sequential formulations. Sequential discovery-exploitation likely holds over shorter time frames but focuses on more aggregate levels of analysis. Symbiotic formulations of discovery-exploitation have the capacity to play out over extended intervals of validity (Zaheer, Albert, & Zaheer, 1999), yet are specified at more micro levels of examination. In particular, theoretical scale addresses the school of theory employed in developing the process formulation, at what scale generalizations are made, as well as what assumptions are required. The sequential formulation of discovery-exploitation draws upon economic theorizing, whereas the symbiotic formulation draws upon psychological and behavioural theory. As a result, there is a separation, between the ecology of the sequential formulation, and specificity of the symbiotic formulation. This demonstrates that the scale of the sequential theory is better suited to draw inference upon the general flow of actions which encompass the discovery-exploitation process. In addition, this macro scale is not something that is necessarily negated by a symbiotic process formulation. It is possible to have a generally sequential process which is at the same time exhibits specific symbiosis. Although, the observation that the "venture creation processes can follow almost any sequence" (Davidsson, 2004: 25) may be made of any individual creation attempt. There is no conceivable external force which would negate this observation; the entrepreneur is free to choose any path toward venture creation. Generally, however, discovery-exploitation theory suggests that in the population of venture creation sequences there is a normative sequence: "the process is - on average – directional" (Davidsson, 2003: 90). From this reasoning and preceding elaboration, the following hypothesis is offered:

> *H3: The general direction of the venture creation process flows from discovery towards exploitation; such that venture creation behaviours of discovery more likely precede exploitation behaviours, than vice versa.*

Ultimately it may not be possible to have a theory that is applicable across all scales, that holds in general and in specific. Should this be so, then this research is a step in the direction of defining where the boundary is between sequential and symbiotic theories of the discovery-exploitation process.

METHOD

The general discovery-exploitation order, and specific sequence effect hypotheses were tested using data collected as part of the Comprehensive Australian Study of Entrepreneurial Emergence (CAUSEE) (Davidsson, Steffens, Gordon, & Reynolds, 2008). CAUSEE is a PSED-like (Davidsson & Gordon, in press) panel-study of venture creation attempts as they unfold. Participants were drawn from a random sample of 491 nascent ventures. That is, at recruitment the nascent ventures were ongoing but not yet fully active in the market. The data used in this research were from those who had participated in two annual interviews. Responses to questions about the completion and timing of thirty possible venture creation activities were used to measure the discovery and exploitation sub-processes as a timeline, or activity sequence. The first interview also captured information on the characteristics of the venture and the human and social capital resources available to it, while the second interview, one year later, assessed venture creation outcomes. The remainder of this section gives further details on the variables measured, the analytical approach adopted, with particular focus on how sequence similarity measures were developed.

Dependent variables: Venture creation attempt outcomes.

A trichotomous dependent variable (DV) was used to measure outcomes for the venture creation attempt, as is the case with other research on nascent venture creation (Davidsson & Gordon, in press). The three levels of the DV indicate whether a) the attempt has been terminated and no longer actively being pursued b) the attempt be considered operational, having maintained consistent sales in the market for six of the previous twelve months, or c) that the attempt has not yet resolved to either of these states, and thus remains ongoing (short hand label: "still tyring"). Outcomes variables were measured during the second year of data collection and therefore are temporally separated from both control and independent variables which were measured in the first year, or prior to sales being made.

Independent variables: Venture creation process sequence similarity

As noted by Bird and Schjoedt (2009) in studying entrepreneurial behaviour it is important to focus on just that, by operationalising observable tasks or activities; rather than what outcomes entrepreneurial behaviour may facilitate (Davidsson, 2004). Importantly therefore venture creation activity measures were restricted to those over which the nascent venture has full discretion as to their completion or not, and over the timing of this activity. The full list of thirty actions that were used to operationalise the venture creation process is detailed in Table 1. The nine actions that operationalize the discovery sub-process focus solely on the conceptual side of venture creation. Specifically, these actions dealt with planning and projecting future information, venture concept development. The remaining twenty-one actions were more directed and concrete actions that set about enacting the venture, thus they operationalise exploitation. Here, exploitation type actions involve specific interactions with the market, the gathering of physical and financial resources. The classification of these actions into discovery and exploitation was undertaken by two independent, and knowledgeable raters, and are coherent with prior research (Farmer, Yao, & Kung-Mcintyre, 2011). Month-of-completion information was used to establish the temporal order in which these activities occurred, or co-occurred.

For temporal activities there are three possible orders in which two events may be configured: a) an event may happen before another, b) an event may happen at the same time as another or c) an event may happen after another. In the case of a) and c) there is no extra coding required to place these two activities in order. When activities happen together it is impossible to tease their "order" apart. To avoid information loss, multiple activities occurring simultaneously, were coded for by allocating these events adjacent numbers in the sequence order. A single type of action occurring during a month was coded according to whether it was discovery or exploitation.

In cases where multiple (but exclusively) discovery (Disc) actions or multiple (but exclusively) exploitation (Expl) actions occurred these codes were used. However, when more than one event type happened (i.e. both discovery and exploitation) this was coded as "simultaneous discovery / exploitation" (DiEx). Accordingly, this latter (DiEx) code captured symbiotic discovery-exploitation. Therefore the combined temporal / gestation sub-process coding resulted in three classes of action: discovery (Disc), simultaneous discovery-exploitation (DiEx), and exploitation (Expl). These actions were arranged in the order in which they were engaged to give a complete "venture creation sequence". This holistic measure of ordered actions then captures the venture creation process sequence.

There are a number of ways to deal with sequence information (Abbott, 1990), however few analytical methods systematically account for qualitative and quantitative variation as well as temporal order, and fewer still do so without becoming unwieldy at larger sample sizes. Sequence analysis which employs "optimal matching" is one such technique (Abbott, 1995). The optimal matching sequence analysis method corresponds with the process nature of the venture creation phenomenon (van de Ven & Engleman, 2004), inherently includes order, and allows for entire timelines of activity to be analysed simultaneously by generating metrics of sequence similarity. This technique has found its most extensive social science application in the field of sociology where it has been used to document careers (Abbott & Hrycak, 1990), however, there are recent examples in organisation studies and management research: examining information systems projects (Sabherwal & Robey, 1993), competition (Ferrier, 2001), and firm acquisitions or alliances (Shi & Prescott, in press).

Optimal matching quantifies the difference or distance between two sequences "as the number of operations it takes to transform one sequence into the other. More specifically, the technique allows the operations "substitution" (changing one element into another element), "insertion" (insert an element at a specific position), or "deletion" (delete an element at a specific position)" (Brzinsky-Fay & Kohler, 2010: 360). Insertion and deletion operations are often abbreviated as "indels". Each of these substitution or indel operations is assigned a "cost" and the total cost then defines the distance between the sequences, with optimal cost calculations derived using the Needleman-Wunsch algorithm (Needleman & Wunsch, 1970). To illustrate how this works it is perhaps best to look at an example; the following, originally detailed in Kruskal (1983: 210) considers the alphabet as elements and words as the sequence of those elements. To convert the sequence I N D U S T R Y into I N T E R E S T, the sequences are first aligned:

I N D U S T ▉ R ▉ Y ▉
I N ▉ ▉ ▉ T E R E S T

The following substitution and indel operations are then required: Staring with INDUSTRY; delete D = INUSTRY; delete U = INSTRY; substitute Y by S = INSTRS; insert E = INSTERS; insert E = INSTERES; delete S = INTERES; insert T = INTEREST. Therefore this comparison requires one substitution, three insertions, and three deletions (or six indels). Should the costs for these parameters all be set to be one, the total distance between the two sequences would be seven.

Cost values for substitutions and indels are assigned by the researcher. The fact that this is often made in an arbitrary fashion, in absence of any theoretical argument, is one potential weakness to the method (Brzinsky-Fay & Kohler, 2010). However, in this research a fixed substitution cost was assigned that accorded with the aim of highlighting sequence order. In this case it is "sensible to set substitution costs to double the indel costs" (Brzinsky-Fay, Kohler, & Luniak, 2006: 450). Accordingly, the indel cost for all computations was set to one and the substitution cost for all combinations to two. Using this cost structure qualitative variation is weighted over quantitative variation and "the timing of events is less important than their order"

(Lesnard, 2010: 397). The following examples illustrate what this means for discovery-exploitation sequence data: The distance between the two element sequence Disc-Disc and the three element sequence Disc-DiEx-Disc would be one, as it requires one insertion. The distance between the sequence Disc-Disc and the sequence Disc-Expl-Expl would be three, as two deletions and one insertion are required. The distance between Disc-Disc and Expl-Expl is computed to be four as two insertion-deletion operations are required. Sorting these sequences by similarity to the sequence Disc-Disc, optimal matching suggests that Disc-DiEx-Disc is closer than Disc-Expl-Expl and in turn closer than Expl-Expl. It can be seen from these results that this cost solution captures sequence order similarity characteristics coherently, and offers a way forward in the analysis of entire processes, which accounts both for their qualitative and quantitative difference.

Independent variables of sequence similarity were then constructed to operationalise the sequential and symbiotic processes as hypothesized earlier, by comparing the empirically observed sequences with theoretical orderings using optimal matching. Four independent variables were constructed, the first captured a strictly sequential process, the second a purely symbiotic process, the third combined a sequential-symbiotic process, and the forth followed a purely random process ordering. To operationalize the sequential process (Disc-Expl) a reference sequence where all (9 possible) discovery actions occurred before the remaining (21 possible) exploitation actions was used. The independent variable therefore was computed as the optimally matched similarity between the empirical sequence and this reference sequence (Disc-Expl). The three remaining independent variables were constructed in a similar fashion. A symbiotic process (DiEx) was referenced using all actions of discovery and exploitation co-occurring. A combined sequential-symbiotic sequence (DiEx-Expl) used a reference where the initial twelve actions were simultaneous discovery-exploitation and the remainder were purely exploitation actions. Finally a reference sequence (Random) was generated using a random process which selected from the three possible action states. This random sequence served two purposes. Firstly this operationalises whether or not a chaotic gestation sequence achieves adequate venture creation outcomes. Secondly, the random sequence serves as a methods or manipulation check for the previous sequence similarity measures. It is important to note that the reference sequences used to generate these measures were each of the same length. Thus, the similarity indices generated by their comparison to the empirical gestation processes observed only differ in the qualitative composition and temporal order by which they unfold.

Control variables: Venture type, aspiration, process and effort.

In order to control for competing explanations of nascent venture creation outcomes, and the process towards it, it is necessary to include variables which may be influential on both. Previous research has highlighted many coincident causes for venture creation outcomes and process variation, as a result we include covariates which account for variation in the type of venture (Liao & Welsch, 2008; Samuelsson & Davidsson, 2009) [14 variables: regional location; nine industry dummies; independent business dummy; product dummy; high technology dummy; and venture novelty] variation in aspiration (Cassar, 2007; Brush, Edelman, & Manolova, 2008a) [3 variables: growth focus; online sales dummy; and international sales aspiration], variation in resources available and applied (Gatewood, Shaver, & Gartner, 1995; Davidsson & Honig, 2003; Delmar & Shane, 2006; Townsend, Busenitz, & Arthurs, 2010) [2 variables: venture level human and social capital], variation in the process (Alsos & Kolvereid, 1998; Delmar & Shane, 2003; Liao et al., 2005; Newbert, 2005) [1 variable: perceived process length], time of entry into the sample (Lichtenstein, Carter, Dooley, & Gartner, 2007) [1 variable: years in process], and the level of effort applied to venture creation (Carter, Gartner, & Reynolds, 1996; Edelman & Yli-Renko, 2010) [2 variables: full-time start-up effort and concurrent businesses dummies].

Analytical Approach

Multinomial logistic regression models were derived for each set of trichotomous dependent variables, using venture termination as the base category in each instance. Initial models included only controls, secondary models then introduced the independent sequence similarity variables under test, and assessed the influence on model fit. Additional post hoc-tests confirmed the statistical validity of all three within-model dichotomous outcome comparisons, and isolated the differential effects. Further, between-model comparisons were made to aid interpretation of the overall effects. In addition, general order effects were assessed using statistical tests of ordered event pairs descriptive statistics. In addition regression models were developed to model the slope of between state probabilities as they change over the sequence length.

RESULTS

In the sample of 491 venture creation attempts there were a total of 6932 individual gestation actions taken, just over half of these (51.4%) categorised as simultaneous discovery and exploitation behaviour (variable descriptive statistics and correlations are detailed in Table 3). This is clearly the most prevalent type of behaviour and provides evidence that discovery and exploitation processes are often temporally intertwined. Figure 1 displays the distribution gestation sequences over the entire empirical sample. The most likely (modal) sequence highlights that discovery actions occur early in the process while exploitation actions are evident latter. Robust linear regression analyses of the pooled state probabilities over the gestation process in sequence order show a pattern of decreasing probability of discovery (b = -0.008, t = -6.788, p = 0.000) and simultaneous discovery-exploitation (b = -0.007, t = -2.265, p = 0.032) action over the process, while exploitation increases (b = 0.018, t = 12.195, p = 0.000). The slope of linearly regressed state probabilities serves to confirm these as non-negligible effects. Capturing process "direction" was also achieved by examining matched pairs of adjacent actions. These pair-wise state transitions between actions accordingly support (b = 0.424, t = 9.668, p = 0.000) the general discovery-exploitation sequence hypothesis, with transitions from discovery to exploitation (M = 1.87) more prevalent than the inverse (M = 1.45). This establishes that, as theorised, distinct discovery activity more likely occurs early in venture emergence, falling away as it unfolds. Distinct exploitation activity seems increasingly likely as the venture creation attempt approaches conclusion. Together these results provide evidence for the general order hypothesis (H3).

No effect is evident (see Table 2 Model V) for a random sequence ($\Delta\chi^2$ = 2.305, p = 0.316) either being a driver of termination (b = 0.066, z = 1.418, p = 0.156) or success (b = 0.018, z = 0.441, p = 0.659). It is clear that a random process which often transitions between different types of action is at best neutral or at worst unfavourable for venture creation. Further, ventures that remain "still trying" exhibit more transitions between gestation action types (F = 5.11, p = 0.006), and are more likely to revisit the conceptual stage after exploitation (F = 5.83, p = 0.054) than operational ventures. Across the other three coherent reference sequences (Disc-Expl; DiEx; DiEx-Expl) the only difference is the order in which gestation actions are completed, however this drives the quality of venture outcomes achieved all cases (see Table 2 Models II, III, IV). Collectively these results provide support for the presence of specific sequence effects on venture outcomes.

With regards to the sequential and symbiotic reference processes tested, a clear result is the differential effect on outcomes, the former less are likely to become operational ($\Delta\chi^2$ = 9.219, p = 0.010) while the latter are more likely to do so ($\Delta\chi^2$ = 10.765, p = 0.005). Though distinct discovery action is influential ($\Delta\chi^2$ = 13.673, p = 0.001), it does not drive successful venture creation (b = -0.24, z = -3.503, p = 0.000). Those ventures which engage in increased discovery are more likely still trying to pursue their venture creation attempt (b = -0.17, z = -2.369, p =

0.018). Terminated ventures are less likely to transition into exploitation (F = 8.54, p = 0.014), remaining in the conceptual stage, in addition to having a shorter process (F = 23.39, p = 0.000). Compared with terminated ventures, increased exploitation action ($\Delta\chi^2$ = 11.925, p = 0.003) both increases the likelihood of becoming operational (b = 0.11, z = 2.778, p = 0.005) as well as the likelihood of remaining in the venture creation process (b = 0.14, z = 3.206, p = 0.001). This result indicates that exploitation action staves off venture termination, at the same time increasing both the chance of becoming operational and characterising an extended gestation processes. However, despite evidence of the general order of the gestation process proceeding from discovery to exploitation; this sequence characteristic does not drive positive outcomes. For processes approaching a strict sequence (Disc-Expl) results show (see Table 2 Model II) a 4.5% decrease in the odds (b = -0.046, z = -2.735, p = 0.006) of becoming operational over remaining still trying in their process for every increment of sequence similarity. In fact, ventures still trying to become operational, more likely follow this sequential process (Disc-Expl) enacting discovery prior to exploitation (F = 6.18, p = 0.002). As a result these findings do not support the specific sequence effect hypothesis (H1).

Simultaneous discovery and exploitation actions ($\Delta\chi^2$ = 23.255, p = 0.000) increase the probability of becoming operational (b = 0.12, z = 4.330, p = 0.000), without extending the process (b = 0.05, z = 1.539, p = 0.124). For venture creation sequences most similar to the symbiotic reference sequence (DiEx) characterized by the continual interweave of discovery-exploitation (see Table 2 Model III) the results prove positive for reaching consistent sales ($\Delta\chi^2$ = 10.765, p = 0.005). The marginal effect for this sequence pattern is to increase the odds of becoming operational by 4.8% over those still trying (b = 0.047, z = 3.062, p = 0.002). In addition to being more likely to enact a symbiotic sequence (DiEx) operational ventures (F = 16.69, p = 0.000) are less prone to making chaotic transitions between actions states (F = 6.96, p = 0.001). This provides evidence in support of the specific symbiosis hypothesis (H2).

Finally, gestation processes similar to those which combine both sequence and symbiosis (DiEx-Expl) are less likely ($\Delta\chi$2 = 16.194, p = 0.000) to have terminated (see Table 2 Model IV) and more likely to become operational. The marginal effect for sequence similarity is an 11.7% increase in the odds of becoming operational (b = 0.111, z = 3.873, p = 0.000) and 5.8% increase in the odds of remaining "still trying" (b = 0.060, z = 1.951, p = 0.051) as compared to termination. The overall effect in this case is stronger than a purely symbiotic venture creation process.

DISCUSSION

This study empirically examined the nature of the venture creation process by focusing on the temporal order of discovery and exploitation actions that constitute it. This was achieved by considering the sequence of venture creation actions at multiple scales. Summarizing the findings on general temporal order, it was evident that in the population the general flow of the venture creation process is in fact a directional sequence from discovery toward exploitation. However findings also show that the majority of individual events are a symbiosis of discovery and exploitation action. This study replicates the finding in Baker et al. (2003) that improvisational venture creation processes are in the majority. This gives credence to formulation of the process, as both sequence and as symbiosis. However, the normative finding is coherent with the scale at which the observation is made, and supports Eckhardt & Shane's (2003, 2010) general directional theory of the entrepreneurship process where discovery precedes exploitation.

Findings are also clear in a number of specific aspects. At finer scales of detail the venture creation process is much less likely to exhibit the general properties of the normative sequence. Although complex, start-up sequences are not random. Specific action types and sequences of the discovery-exploitation process have an effect on the venture creation outcomes. Discovery alone is

deemed insufficient for venture creation; however, exploitation is necessary; while intertwined and symbiotic discovery-exploitation is particularly beneficial, and even more so in the short run. Further, a sequential process is less successful than a symbiotic process. Specifically sequential processes in which all discovery behaviour precedes all exploitation behaviour achieve poor outcomes. Specifically symbiotic processes in which discovery and exploitation unfold simultaneously are more likely to achieve positive outcomes. However, both of these process formulations are less successful than combining them together as a dual sequential-symbiotic process, that which is at once both directional and adaptive. Processes which transition out discovery-exploitation into exploitation while marginally more likely to continue their attempt are far more likely to achieve positive outcomes than other process types. This has a number of implications for theory, encourage further empirical sophistication, and have substantive practical consequences.

It is clear that even simple conceptualizations employing substantive forces such as discovery and exploitation give rise to complex structures in the venture creation process as it plays out over time. This is significant given the observation that too many points of variation could lead to confounded results (Davidsson & Gordon, in press), especially in conjunction with the exponential complexity derived from a dual conceptualization of discovery and exploitation. The nature of these findings also suggests that in future employing a complexity theory framework may be beneficial to theorizing on the venture creation process (McKelvey, 2004). Another theoretical affinity aligns with scholarship on organizational learning (March, 1991), were direct analogy may be drawn between discovery-exploitation and exploration-exploitation. In organizational learning adaptive processes are beneficial in the short run but destructive in the long run. If the same effect is mirrored in venture creation excessive iteration while promoting adaptation, may not facilitate progress. In addition, there are a number of reasons to encourage the synthesis of sequential and symbiotic process models of venture creation. Firstly, the tentative progress made in this study suggests that this theory extension might be achievable. Secondly, the evidence in this study also suggests that any synthesis which pays attention to scale in a sophisticated way will more likely be successfully generalized. Thirdly, given that different aspects of these process formulations seem to highlight complimentary aspects of venture creation, their fusion should be mutually beneficial. In the face of a phenomenon as heterogeneous as entrepreneurship is, this final observation is encouraging.

A potential limitation to this study is that the temporal scale of observation was too coarse. The data was collected on a month by month resolution. Finer detail data might reveal that no discovery-exploitation actions were substantively simultaneous, and that the observations were an artefact of temporal aliasing. Despite this, there are a number of methodological implications that may be drawn. Firstly, as research into sequences of organizing activities must aim for generalised knowledge about the venture creation process, conceptual grouping of actions (e.g. Brush et al., 2008b) in empirical studies is to be encouraged in future, not doing so just makes the task more complex. Secondly, in light of the findings of this research failing to incorporate temporal order in any process analyses can only result in an incomplete understanding of entrepreneurship. Thirdly, the optimal matching method introduced here might be usefully applied to other entrepreneurship research, for example the study of serial entrepreneurship or entrepreneurial career histories of those who move into and out of entrepreneurial efforts. While this study offers a methodological advance over what has currently been applied in entrepreneurship research to study process, these findings should still be treated as tentative given the novelty of the technique. Replication of this study is to be encouraged to establish the robustness of the results.

Finally, an implication of this study for practitioners is that while no “recipe” for success has been found, some ingredients have been identified. Firstly, entrepreneurs should be encouraged to compress their start-up process if they can. Doing things simultaneously is

beneficial. In addition, adaptation is a driver of success, therefore responsiveness should be encouraged. However, the entrepreneur needs to be wary that they do not get caught in excessive iteration, and continual discovery, this is detrimental. The overall message though is to ramp up exploitation activity in order to make progress, and to ultimately set aside discovery to be successful.

CONCLUSION

Whether there is an order to the sequence of activities undertaken during the process of venture creation is a question deemed important to answer in developing our understanding of entrepreneurship. An ordered process where discovery precedes exploitation as a sequence is considered at one end of a spectrum of processes types compared to one where these behaviours overlap, are inseparably entangled and thus symbiotic. The empirical research presented here highlights that both types of process orderings exist in a random sample of nascent venture creation attempts. What is clear, however, is that there is an underlying order to the venture creation process, and that order influences the outcomes achieved, though not in ways that might be expected. Firstly, the process of venture creation is generally directed, flowing from discovery toward exploitation. Secondly, despite the generally directed nature of the process, those venture creation attempts that proceed by specifically enacting discovery and exploitation in symbiosis, are more likely to achieve better outcomes for their effort, than those that proceed sequentially. As a result the venture creation process seems to be a multi-scale phenomenon, which is at once a general sequence of discovery followed by exploitation, and the same time a specific symbiotic construct of discovery and exploitation together. Thus, despite clear conceptual distinctions it may be that, at least temporally, it is difficult to de-couple discovery from exploitation.

CONTACT: Scott Gordon; sr.gordon@qut.edu.au; (T) +617-3138-2499; (F) +617-3138-5250; Australian Centre for Entrepreneurship Research, QUT Business School, Queensland University of Technology, GPO Box 2434, Brisbane 4001, Australia.

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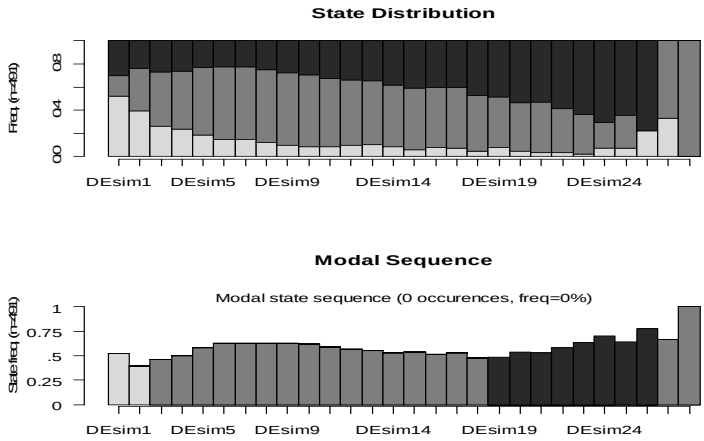
Table 1 - Gestation Activity Classifications

Discovery (Disc)	Exploitation (Expl)	
Started thinking about business	Registered business name	Registered for payroll tax
Began product development	Decided location for business	Sought outside funding
Developed proprietary technology	Established legal form	Established supplier credit
Commenced customer discussions	Signed ownership agreement	Hired employee
Collected competitor information	Began marketing	Opened business bank account
Defined market opportunities	Applied for IP protection	Invested own money
Produced financial projections	Leased equipment / facilities	Retained an accountant
Assessed regulatory requirements	Purchased materials /inventory	Retained a lawyer
Began developing business plan	Purchased liability insurance	Made business contactable
	Registered business number	Created business website
	Registered for GST	

Figure 1 – Venture creation process – sequence distribution.



Note: Disc = Light grey; DiEx = Medium grey; Expl = Dark grey.

Table 2 - Multinomial logistic regression models of sequence similarity on venture outcome.

	Independent Variables	Model I		Model II		Model III		Model IV		Model V	
		Try	Oper	Try	Oper	Try	Oper	Try	Oper	Try	Oper
	Constant	0.076*	0.631	0.090*	0.169	0.051**	1.281	0.267	6.411†	0.255	0.894
		(0.08)	(0.55)	(0.11)	(0.18)	(0.06)	(1.20)	(0.32)	(6.84)	(0.33)	(1.04)
	Regional Location	0.766	1.114	0.772	1.14	0.778	1.128	0.788	1.149	0.774	1.125
		(0.21)	(0.29)	(0.22)	(0.29)	(0.22)	(0.29)	(0.22)	(0.30)	(0.22)	(0.29)
	Indep. Business	2.912**	1.154	2.949**	1.179	2.934**	1.21	3.080**	1.286	2.962**	1.156
		(1.07)	(0.34)	(1.09)	(0.36)	(1.09)	(0.37)	(1.15)	(0.39)	(1.10)	(0.35)
	Product Based	0.747	0.538†	0.771	0.516*	0.782	0.516*	0.718	0.509*	0.726	0.534†
		(0.26)	(0.18)	(0.27)	(0.17)	(0.27)	(0.17)	(0.25)	(0.17)	(0.25)	(0.18)
	Venture Novelty	0.992	0.913	0.993	0.912	0.993	0.913	0.994	0.916	0.989	0.911†
		(0.06)	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)
	High Technology	1.541	0.859	1.515	0.838	1.513	0.832	1.552	0.877	1.56	0.867
		(0.48)	(0.26)	(0.47)	(0.26)	(0.47)	(0.25)	(0.48)	(0.27)	(0.48)	(0.26)
	Brick & Mortar	1.121	1.880*	1.118	1.918*	1.104	1.937*	1.132	1.925*	1.124	1.891*
I		(0.32)	(0.50)	(0.32)	(0.51)	(0.32)	(0.52)	(0.33)	(0.52)	(0.32)	(0.50)
	Growth Focus	1.723†	0.956	1.755†	0.902	1.767†	0.903	1.644	0.897	1.756†	0.96
		(0.56)	(0.31)	(0.58)	(0.29)	(0.58)	(0.29)	(0.54)	(0.30)	(0.57)	(0.31)
	Int. Aspiration	1.004	0.998	1.004	0.999	1.004	0.999	1.005	0.999	1.004	0.998
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Years Active	1.045	1.022	1.046	1.026	1.045	1.029	1.056†	1.04	1.046	1.022
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
	Perceived Process	1.021	0.985	1.023	0.989	1.022	0.989	1.027	0.993	1.021	0.985
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
	Other Venture	0.825	0.978	0.802	0.991	0.796	1.004	0.83	0.96	0.843	0.986
		(0.25)	(0.28)	(0.25)	(0.28)	(0.25)	(0.29)	(0.26)	(0.28)	(0.26)	(0.28)
	Full-Time Effort	2.664**	4.429***	2.714**	4.147***	2.763**	4.107***	2.491**	3.922***	2.784**	4.508***
		(0.86)	(1.33)	(0.88)	(1.25)	(0.90)	(1.24)	(0.81)	(1.19)	(0.90)	(1.36)
	Human Capital	1.222*	1.056	1.221*	1.069	1.219*	1.069	1.219*	1.053	1.220*	1.055
		(0.10)	(0.08)	(0.10)	(0.08)	(0.10)	(0.08)	(0.10)	(0.08)	(0.10)	(0.08)
	Social Capital	1.053	1.258*	1.052	1.272*	1.048	1.268*	1.038	1.235†	1.064	1.261*
		(0.12)	(0.13)	(0.12)	(0.14)	(0.12)	(0.13)	(0.12)	(0.13)	(0.12)	(0.13)
II	Seq 1 - Disc-Expl			1.008	0.963*						
				(0.02)	(0.02)						
III	Seq 2 - DiEx					0.987	1.034*				
						(0.02)	(0.02)				
IV	Seq 3 - DiEx-Expl							1.062†	1.117***		
								(0.03)	(0.03)		
V	Seq 4 - Random									1.068	1.019
										(0.05)	(0.04)
	N		479		479		479		479		479
	Model X^2		131.495***		140.714***		142.260***		147.689***		133.800***
	Log likelihood		-445.468		-440.858		-440.085		-437.371		-444.315
	Cox & Snell R^2		0.24		0.255		0.257		0.265		0.244
	Nagelkerke R^2		0.272		0.289		0.291		0.301		0.276
	ModelΔ X^2				9.219*		10.765**		16.194***		2.305

Note: Contrasts still trying (Try) or becoming operational (Oper) outcomes against base outcome of terminating the venture creation attempt; Industry dummy variables included in all regressions; Regression parameters expressed as odds ratios, standard error in brackets(); † $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Two-tailed significance test used for hypotheses tests.

Table 3 - Research Variables – Descriptive Statistics and Correlations

	Variables	Descriptives					Outcome		Control						
		N	min	max	M	SD	1	2	3	4	5	6	7	8	9
1	Terminated	491	0	1	0.28	0.45	1								
2	Still Trying	491	0	1	0.31	0.46	-0.42*	1							
3	Operational	491	0	1	0.44	0.50	-0.41*	-0.59*	1						
4	Regional Location	491	0	1	0.50	0.50	0.00	-0.14*	0.11*	1					
5	Indep. Business	491	0	1	0.80	0.40	-0.15*	0.14*	-0.07	-0.04	1				
6	Product Based	491	0	1	0.39	0.49	0.11*	0.01	-0.09	0.07	-0.04	1			
7	Venture Novelty	491	0	12	3.84	2.45	-0.03	0.15*	-0.13*	-0.10*	0.00	0.05	1		
8	High Technology	491	0	1	0.31	0.46	-0.09	0.18*	-0.12*	-0.11*	-0.05	-0.05	0.24*	1	
9	Brick & Mortar	491	0	1	0.50	0.50	-0.05	-0.14*	0.19*	0.13*	-0.06	-0.11*	-0.17*	-0.14*	1
10	Growth Focus	491	0	1	0.26	0.44	-0.05	0.20*	-0.14*	-0.13*	0.01	0.10*	0.19*	0.17*	-0.19*
11	Int. Aspiration	481	0	100	50.98	35.53	-0.04	0.17*	-0.14*	0.01	0.01	0.24*	0.18*	0.20*	-0.29*
12	Years Active	489	0	32	3.30	4.66	-0.07	0.08	-0.03	0.02	-0.03	0.09*	0.07	0.05	0.00
13	Perceived Process	491	4	22	16.52	3.63	-0.04	0.11*	-0.07	-0.16*	0.00	0.04	0.25*	0.16*	-0.10*
14	Other Venture	491	0	1	0.35	0.48	0.02	0.03	-0.01	-0.08	-0.10*	0.08	0.07	0.09	-0.06
15	Full-Time Effort	491	0	1	0.37	0.48	-0.24*	0.05	0.17*	0.00	-0.02	-0.03	0.12*	0.09	0.02
16	Human Capital	491	0	9	5.46	1.79	-0.10*	0.15*	-0.04	-0.16*	-0.04	-0.01	0.11*	0.12*	-0.11*
17	Social Capital	491	0	7	2.36	1.32	-0.12*	0.02	0.08	-0.03	-0.03	0.05	0.13*	0.10*	-0.10*
18	Seq 1 - Disc-Expl	491	-51	-7	-30.10	7.41	0.05	0.12*	-0.16*	0.00	0.06	-0.03	0.03	0.00	-0.01
19	Seq 2 - DiEx	491	-49	-5	-27.60	8.21	-0.03	-0.15*	0.17*	0.02	-0.09	0.02	-0.04	-0.01	0.00
20	Seq 3 - DiEx-Expl	491	-35	-9	-23.31	4.77	-0.14*	-0.05	0.20*	-0.01	-0.09*	-0.02	-0.01	-0.03	0.03
21	Seq 4 - Random	491	-30	-13	-20.06	3.15	0.02	0.04	-0.05	-0.01	0.04	0.00	0.01	-0.05	0.00

	Variables	Sequence										
		10	11	12	13	14	15	16	17	18	19	20
11	Int. Aspiration	0.20*	1									
12	Years Active	-0.01	0.14*	1								
13	Perceived Process	0.21*	0.17*	-0.02	1							
14	Other Venture	0.18*	0.15*	-0.07	0.14*	1						
15	Full-Time Effort	0.12*	0.14*	0.01	0.13*	0.10*	1					
16	Human Capital	0.04	0.18*	0.07	0.13*	0.29*	0.08	1				
17	Social Capital	0.07	0.17*	0.04	0.23*	0.18*	0.19*	0.27*	1			
18	Seq 1 - Disc-Expl	-0.04	0.09*	0.09*	0.03	0.06	-0.11*	0.10*	0.04	1		
19	Seq 2 - DiEx	0.03	-0.12*	-0.13*	-0.04	-0.07	0.13*	-0.11*	-0.04	-0.96*	1	
20	Seq 3 - DiEx-Expl	0.04	-0.05	-0.13*	-0.01	0.08	0.16*	0.01	0.06	-0.17*	0.25*	1
21	Seq 4 - Random	-0.07	-0.05	0.02	-0.07	-0.11*	-0.13*	-0.02	-0.13*	-0.07	0.05	0.05

Notes: * $p < 0.05$; All significance tests were 2 tailed.